QM-Height

High-Precision
Digital Height Gage

User's Manual
(Hardware Guide)

Read this User's Manual thoroughly
before operating the instrument.
After reading, retain it close at hand for future reference.

Mitutoyo

[MEMO]

CONVENTIONS USED IN THIS MANUAL

Safety Precautions

To ensure that instruments are operated correctly and safely, Mitutoyo manuals use various safety symbols (Signal Words and Safety Alert Symbols) to identify and warn against hazards and potential accidents.

The following signs indicate **general** warnings:

⚠ **DANGER**	Indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death.
⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

The following signs indicate **specific** warnings or prohibited actions, or indicate a mandatory action:

⚡	Alerts the user to a specific hazardous situation. The given example means "Caution, risk of electric shock".
🚫	Prohibits a specific action. The given example means "Do not touch".
⏚	Specifies a required action. The given example means "Ground".

CONVENTIONS USED IN THIS MANUAL

Types of Notes

The following types of **notes** are used in this manual to help the operator obtain reliable measurement data through correct instrument operation.

IMPORTANT
- An *important note* provides information essential to the completion of a task. You cannot disregard this note to complete the task.

- An *important note* is a type of precaution, which if neglected could result in a loss of data, decreased accuracy or instrument malfunction/failure.

NOTE
A *note* emphasizes or supplements important points of the main text. It also supplies information about specific situations (e.g., memory limitations, equipment configurations, or details that apply to specific versions of a program).

TIP
A *tip* is a type of note that helps the user apply the techniques and procedures described in the text to his or her specific needs.

It also provides reference information associated with the topic being discussed.

Precautions for Use

- Do not use this gage in locations where it will be directly exposed to cutting fluids, water, dust, etc. (Fig.1)
- Do not use this gage in locations where it will be exposed to direct sunlight or a draft of hot air. (Fig.2)
- Use the gage within a temperature range of 0°C to 40°C. When performing precision measurements, the ambient temperature must be maintained as close as possible to 20°C with minimum fluctuation.
- When displacing the gage on a surface plate, slide it by holding the grip.
- To clean the main unit, base, or probe, wipe it using a lint-free cloth or paper towel dampened with a neutral detergent. Do not use an organic solvent such as thinner.
- Absolutely do not apply an external voltage to the QM-Height with, for example, an electric engraver. Failure to observe this may result in troubles. (Fig.3)
- After using the gage, be sure to turn off the power.
- If the gage will not be used for an extended period of time, remove the batteries from the gage. Batteries could leak and damage the gage.
- Do not charge or disassemble the supplied batteries. They may be short circuited.
- Use only LR6 batteries (AA alkaline batteries), or Ni-Mh (nickel hydride batteries). Manage the batteries according to the instructions provided by the battery to be used.
- Do not apply excessive force to the gage or drop it. Also, do not disassemble the gage except to remove the battery case when replacing the batteries. (Fig. 4)
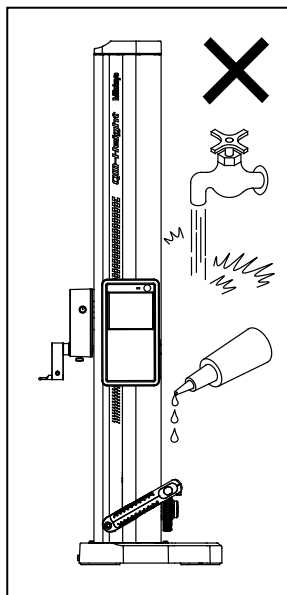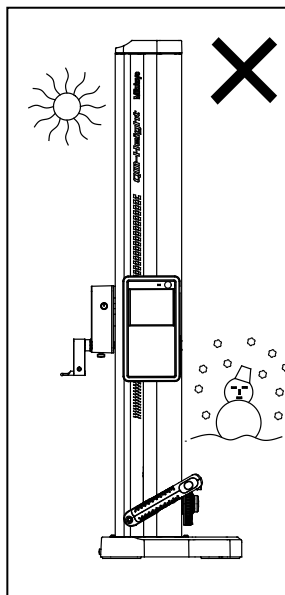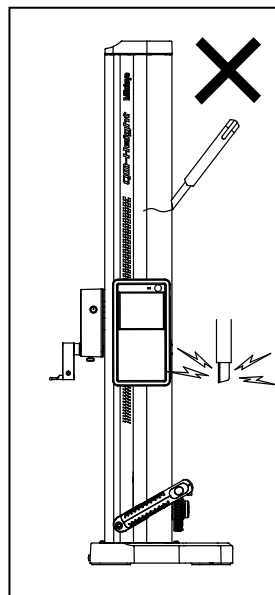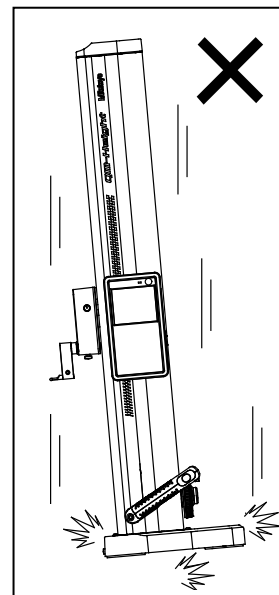
| Fig. 1 | Fig. 2 | Fig. 3 | Fig. 4 |

Warranty

In the event that this product should prove defective in workmanship or material, within one year from the date of original purchase for use, it will be repaired or replaced, at Mitutoyo's option, free of charge upon its prepaid return to Mitutoyo, without prejudice to the provisions of the Mitutoyo Software End User License Agreement.

If this product fails or is damaged for any of the following reasons, it will be subject to a repair charge, even if it is still under warranty.

(a) Failure or damage owing to fair wear and tear.

(b) Failure or damage owing to inappropriate handling, maintenance or repair, or to unauthorized modification.

(c) Failure or damage owing to transport, dropping, or relocation of the instrument after purchase.

(d) Failure or damage owing to fire, salt, gas, abnormal voltage, lightning surge, or natural disaster.

(e) Failure or damage owing to use in combination with hardware or software other than those designated or permitted by Mitutoyo.

(f) Failure or damage owing to use in ultra-hazardous activities.

This warranty is effective only where the instrument is properly installed and operated in conformance with the instructions in this manual within the original country of the installation.

EXCEPT AS SPECIFIED IN THIS WARRANTY, ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES OF ANY NATURE WHATSOEVER INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT OR WARRANTY ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY APPLICABLE LAW.

You assume all responsibility for all results arising out of its selection of this product to achieve its intended results.

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The foregoing limitations shall apply even if the above-stated warranty fails of its essential purpose.

BECAUSE SOME COUNTRIES, STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR THE LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, IN SUCH COUNTRIES, STATES OR JURISDICTIONS, MITUTOYO'S LIABILITY SHALL BE LIMITED TO THE EXTENT PERMITTED BY LAW.

Export Control Compliance

This Product falls into the Catch-All-Controlled Goods and/or Catch-All-Controlled Technologies (including Programs) under Category 16 of Separate Table 1 of Export Trade Control Order or under Category 16 of Separate Table of Foreign Exchange Control Order, based on Foreign Exchange and Foreign Trade Law of Japan.

If you intend re-exporting the product from a country other than Japan, re-selling the product in a country other than Japan, or re-providing the technology (including program), you shall observe the regulations of your country.

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. To reduce the environmental impact of WEEE (Waste Electrical and Electronic Equipment) and minimize the volume of WEEE entering landfills, please reuse and recycle.

For further information, please contact your local dealer or distributors.
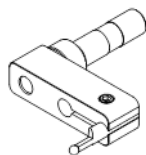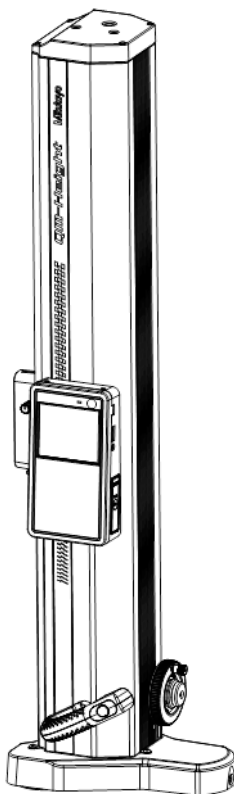
CONTENTS

SERVICE NETWORK

1 BEFORE STARTING MEASUREMENT

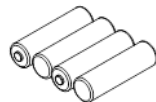This chapter gives the name and function of each part and the setup procedure.

1.1 Checking the Packed Components

After unpacking the product check that all the following components have been included.

• Main unit

• ø5 stepped probe

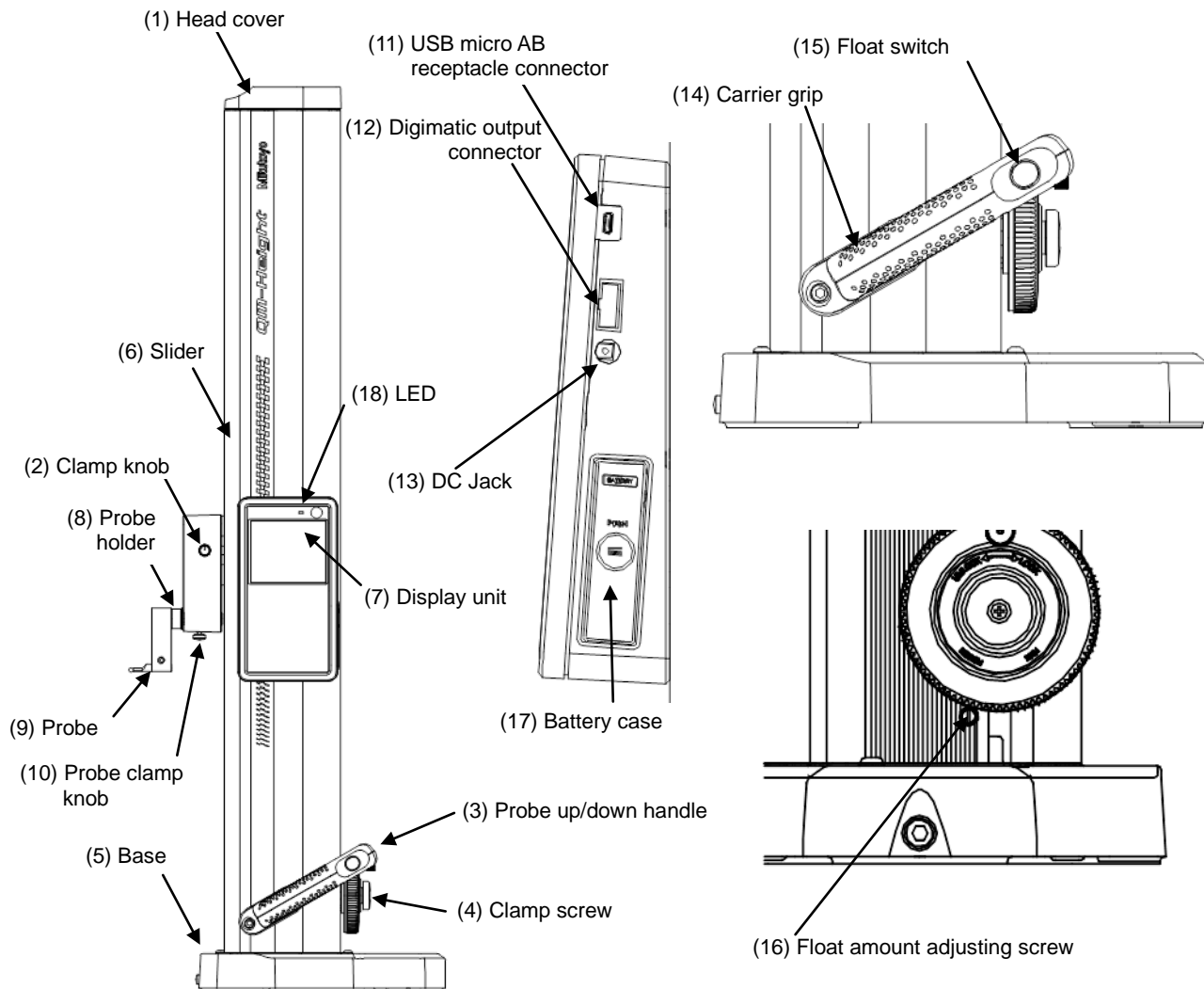• AA alkaline batteries (LR6) 4 pieces

• Ball diameter calibration block

• User's Manual (this manual)
• Unpacking Instructions Sheet
• Setup Procedure Sheet
• Quick Reference Manual
• Warranty Card
• Inspection Certificate
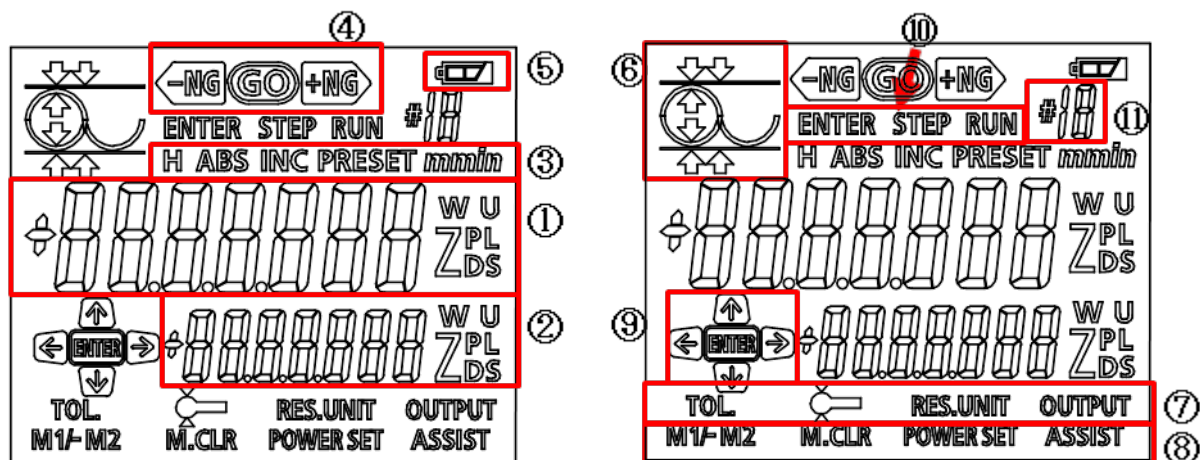
1.2 Name and Function of Each Part

1.2.1 Main unit

(1) Head cover
(2) Clamp knob: Fixes the probe to the slider.
(3) Probe up/down handle
(4) Clamp screw: Fixes the slider.
(5) Base
(6) Slider: Supports the probe.
(7) Display unit: Displays measured values, various messages, etc.
(8) Probe holder: An inlet to set the probe.
(9) Probe: The standard probe is ø5.
(10) Probe clamp knob: A screw to clamp the probe.

(11) USB micro connector:
    Enables USB output
(12) Digimatic output connector:
    Outputs Digimatic code data.
(13) DC jack:
    Allows the optional AC adapter to be used.
(14) Carrier grip: Used when transferring the unit.
(15) Float switch: A switch to float the unit by air.
    (Supported model only)
(16) Float amount adjusting screw: A screw to adjust the float amount of the unit.
    (Supported model only)
(17) Battery case
(18) LED

1.2.2　　　Display unit

(1) Liquid crystal display (LCD)


No.	Indication name	Basic indication and reference pages
(1)	Upper column	Indicates counting in the normal measurement: [2.3.1 Height measurement] [2.3.2 Step measurement] Indicates diameter in the ID, OD measurement: [2.3.3 Inside diameter measurement] [2.3.4 Outside diameter measurement] Indicates displacement at plane scanning measurement: [2.3.5 Plane scanning measurement]
(2)	Lower column	Indicates pitch in normal measurement: [2.3.1 Height measurement] [2.3.2 Step measurement] [2.4.1 Calculating an arbitrary point-to-point distance]
(1) (2)	Symbol	ZP (Pitch): [2.3.1 Height measurement] [2.3.2 Step measurement] [2.4.1 Calculating an arbitrary point-to-point distance] ZD (Dia.): [2.3.3 Inside diameter measurement] [2.3.4 Outside diameter measurement] ZL (max. value), ZS (min. value), W (width): [2.3.5 Plane scanning measurement] U (upper limit value), L (lower limit value): [2.4.3 Tolerance judgment]
(3)	H Measurement system PRESET Unit	H (Hold): [2.4.4 Holding a display value and outputting measured data] ABS (ABS measurement system), INC (INC measurement system): [2.2.1 ABS origin setting] PRESET: [2.2.3 Presetting procedure] mm (Unit: mm), in (Unit: inch, only for inch unit supported models)
(4)	Tolerance judgment	-NG (minus tolerance), GO (within tolerance), +NG (plus tolerance): [2.4.3 Tolerance judgment]
(5)	Power supply low voltage alarm	Gives warning of power supply low voltage: [2.5.2 Error message]
(6)	Guidance Icon	Indicates the probe direction setting: [2.2.2 Setting up the probe] Indicates guidances for measuring direction, and ID, OD, plane scanning measurements: [2.3 Measurement (basic operation)]
(7)	Setting1	Tolerance setting, Probe setting, Resolution, Output setting: [3.1.1 Mode setting]
(8)	Setting2	Memory setup and clearing, Power setting, Assist function setup and execution: [3.1.1 Mode setting]

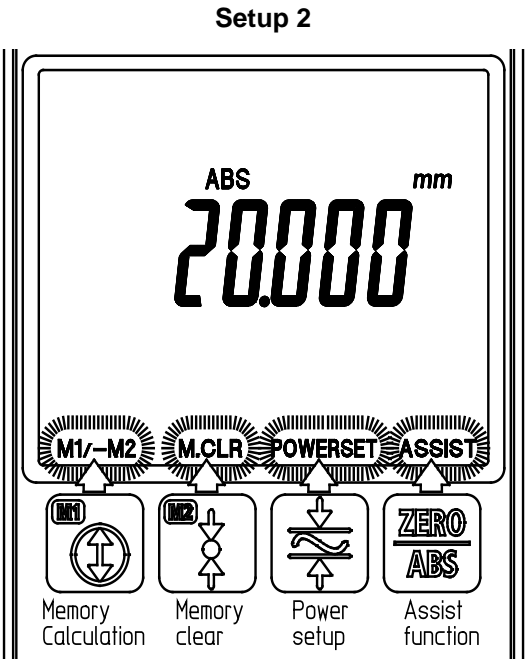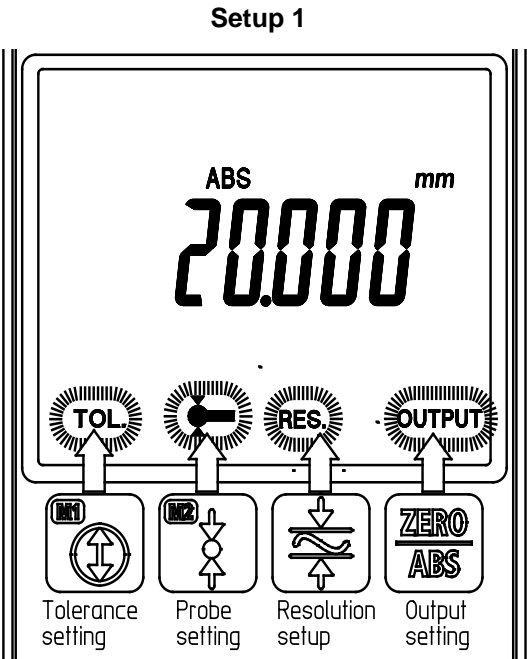| (9)	Cursor Enter	Displays the direction that can be pressed, or when it can be determined.
(10)	Assist function status	Transition of state in the assist function: [3.2.7 Assist function (setup and execution)]
(11)	Assist function No.	Measurement procedure in the assist function: [3.2.7 Assist function (setup and execution)]

(2) Switch unit (for normal operation)
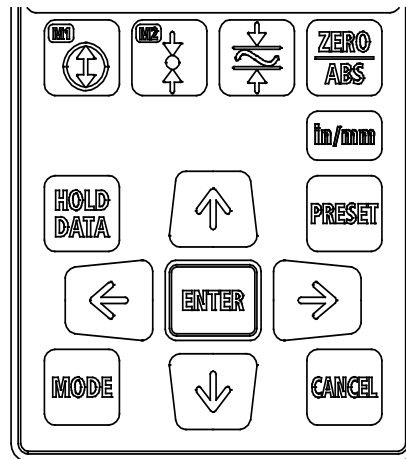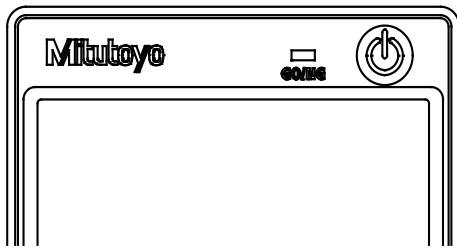
	Normal pressing (less than 1 sec.)	**Long pressing (at least 1 sec.)**
⏻	Turns the power on and off. If no operation is performed for more than 2 minutes, the power is turned off automatically. For information about the Auto Power-off setup, refer to "3.2.6 Setting the power".	
ZERO/ABS	Sets up the INC origin, and enables INC measurement.	Enables the ABS measurement.
PRESET	Sets a preset value.	
HOLD DATA	Holds a measured value, or outputs data.	
In/mm	Switches the unit system between inch and mm. (Only for inch unit supported models)	
M1	Enables the ID measurement.	Saves Memory 1.
M2	Enables the OD measurement.	Saves Memory 2.
⤵	Enables the plane scanning measurement.	
MODE	Enables the mode setting.	
ENTER	Loads each scanning measurement value and various settings.	
CANCEL	Cancels operation.	
⇐	Transfers counting data and items at preset, tolerance setting, or at each mode setting.	
	Pressing the ⇐ button 1 second or more to change the counting polarity.	
	The polarity of the probe's upwards displacement is negative if " " appears on the display, whereas it is positive if " " disappears from the display.	
	Pressing the button 1 second or more again, it will return to the normal counting polarity.	

(3) Buttons (in the mode setting)
For information about the mode setting, refer to section 3.

Buttons to enter the mode setting				
MODE	Enables the mode setting.			
Buttons to select a mode				
	M1	**M2**		**ZERO ABS**
Setup 1	Tolerance setting TOL.	Probe setting	Resolution setup RES.	Output setting OUTPUT
Setup 2	Memory calculation M1 / - M2	Memory clear M.CLR	Power setup POWER.SET	Assist function ASSIST
Buttons for selection, determination, cancellation				
⇐	Transfers counting data and items at tolerance setting or in each mode setting.			
ENTER	Loads each setting.			
CANCEL	Cancels operation.			
Other active buttons				
⏻	Turns the power on and off.			

Setup 1

Setup 2

1.2.3 Function list and Index

Refer to this section when you know what to measure, but you don't know which function should be used.

• About measurement

What you want to do:	Keyword	Reference
Set a reference for measurement.	ABS origin, INC origin	2.2.1
Set an origin other value than zero.	Preset	2.2.3
Measure height in one direction.	Height measurement	2.3.1
Measure steps and internal width.	(Probe setting) INC measurement system	2.2.2 2.3.2
Measure ID and OD.	(Probe setting) ID measurement OD measurement	2.2.2 2.3.3 2.3.4
Measure displacement, maximum value, minimum value of flat surface.	Plane scanning measurement	2.3.5
Measure a distance from the previously measured point.	Calculating point-to-point distance	2.4.1
Memorize the measurement data during measurement. Check the distance between two memorized measurement data	Memorizing measurement data Calculating point-to-point distance	2.4.2
Check the ratio of two memorized measurement data	Calculating point-to-point ratio	2.4.2
Perform measurement in a procedure registered in the assist function.	Assist function	3.2.7

• About settings

What you want to do:	Keyword	Reference
What is required to use this unit for the first time?	Probe setting Reference setting	2.2.2 2.2.1
What needs to be set after replacing the probe?	Probe setting	2.2.2
Register tolerance judgment values (upper/lower limits).	Tolerance judgment	2.4.3
Adjust the LED lighting time in the tolerance judgment.	Power setup	3.2.6
How to set a mode. Setting1: Tolerance, Probe, Resolution, Output Setting12: Memory (Clear), Power, Assist function	Mode Setting	3.1.1
Change the resolution.	Resolution setup	3.2.3
Change the output data from the Digimatic.	Output setting	3.2.4
Change the counting polarity.	Counting polarity setting	1.2.2 (2)
Change the hold mode.	Hold mode setting	2.4.4
Change the digits of the Digimatic output in an inch model.	Output setting	3.2.4
Change the duration time until auto-off after measurement.	Power setup	3.2.6
Register a measurement procedure using the assist function.	Assist function	3.2.7

1.3   Setting Up

1.3.1   Installation Environments

The QM-Height is a precision measuring instrument, and at the same time a precision electronic device. To use the QM-Height accurately, be sure to install it in an environment that satisfies the following conditions.

Important

• **Temperature and humidity**
  • The QM-Height has been adjusted so as to ensure the appropriate accuracy at 20°C. Therefore, it must be used at an ambient temperature of 20°C.
  • Avoid high humidity, direct sunlight, and exposure to cold or hot air flowing from air-conditioners.

• **Vibrations**
  • Install the QM-Height in a place where there is minimum vibration. If vibration affects the QM-Height during measurement, the measured value may become unstable. If the QM-Height is used for an extended period where there is vibration, the precision parts may be damaged, resulting in reduced accuracy.

• **Dust**
  • The linear encoder equipped with this product has a cover. If this linear encoder becomes dusty or scratched, normal operation may not be guaranteed. Further, if dust or grease contaminate the air outlet of the base or the bearing guide surface of the slider, the measuring accuracy may be degraded. Therefore, use the QM-Height in an environment where there is minimum dust.

• **Electromagnetic noise**
  • Do not connect the AC adapter (option) to a power supply for large electric current such as for machine tools or large CNC measuring instruments. Place the QM-Height well away from equipment that generates electromagnetic noise, such as welding machines or electric discharge machines (EDMs).

1.3.2   Installing QM-Height on a surface plate

Important

The following installation work must be done by at least two persons. When unpacking the units, observe the unpacking instructions sheet provided with the containers.

(1) After taking the main unit out of its container, place its base down on a stable bench. Then remove the wrapping.

(2) Wipe off any grime and anti-corrosion oil from the bottom surface of base using a cloth dampened with alcohol. Then set the base gently on the properly cleaned surface plate.

1.3.3   Removing the fixtures for transportation

At shipment, the moving parts such as the slider have been fixed with screws, etc. Remove the fixtures according to the following procedure.
(See Fig.1)
(1) Remove 3 pieces of fixing bolts.
(2) Insert the supplied rubber caps into the holes from which the bolts are removed.
(3) Unscrew the bolts that mount the fixing bracket, and then remove the bracket.
(4) Loosen the clamp screw while holding the handle with one hand. This will allow the probe to be moved up and down. Slightly move up the probe, and then tighten the clamp screw again to fix the slider.
(5) Insert the supplied probe, and then clamp the probe with the probe clamp knob. (Refer to "1.3.5 Attaching the probe".)
(6) Loosen the clamp knob.
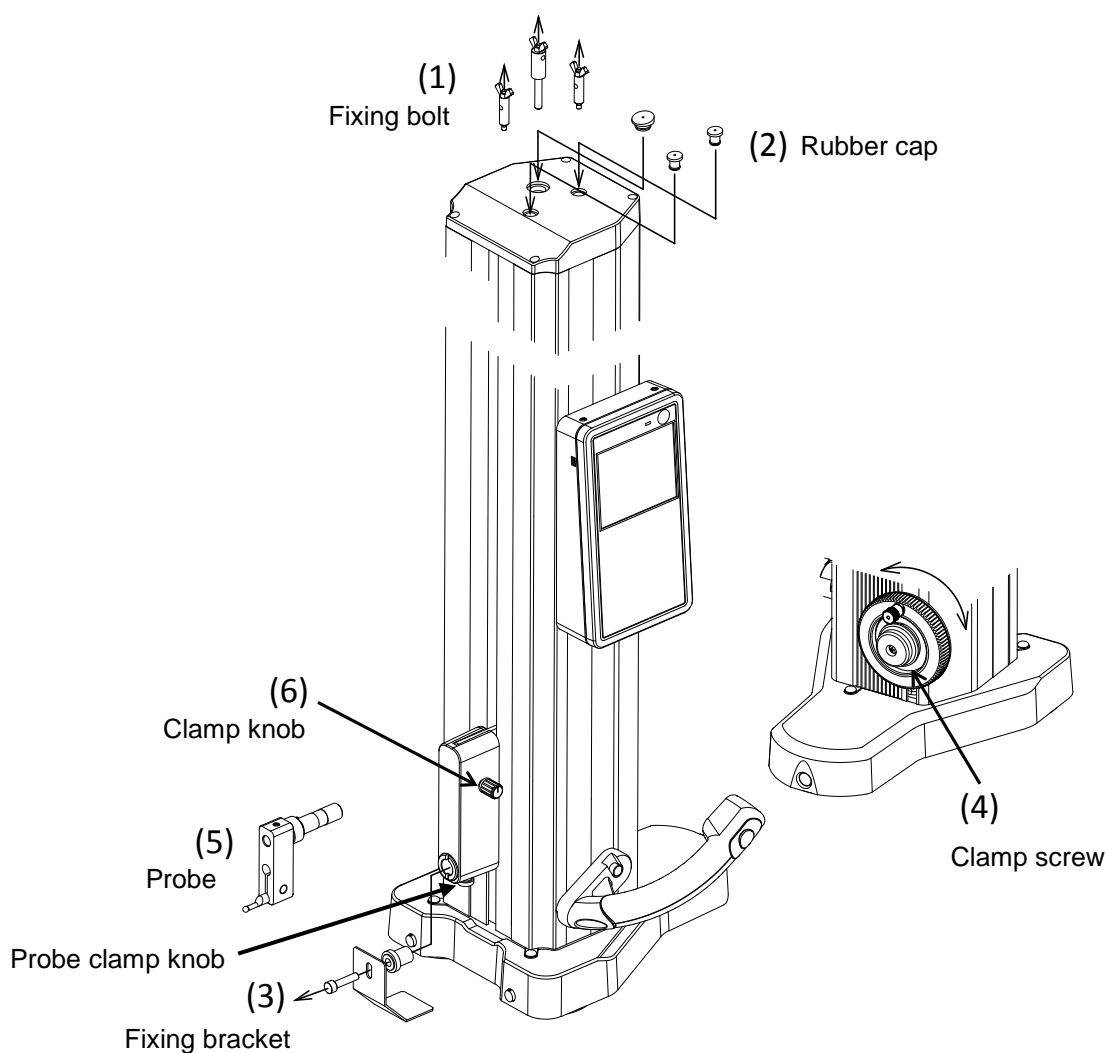
Fig.1

In case of necessity for transporting the main unit after unpacking, reverse the above procedure, and then store it in the container box before transportation. If the main unit is transported without fixing the moving parts, the main unit may be damaged. Therefore, it is recommended to carefully store the fixing bracket, bolts, and packing materials.

1.3.4   Installing the batteries.

This gage is supplied with batteries. They have been packed separately.
Press the center of the battery case (Fig.2) with a finger to withdraw the battery case. Place the supplied batteries in the case, observing correct polarity, and then put back the battery case. The battery case is set when a click sound is heard. (The batteries must be replaced when the battery warning mark is lit on the LCD. Replace all four batteries at the same time.)

Note	The supplied batteries are used only for the purpose of checking the functions and performance of the product, therefore it may not satisfy the specified battery life.
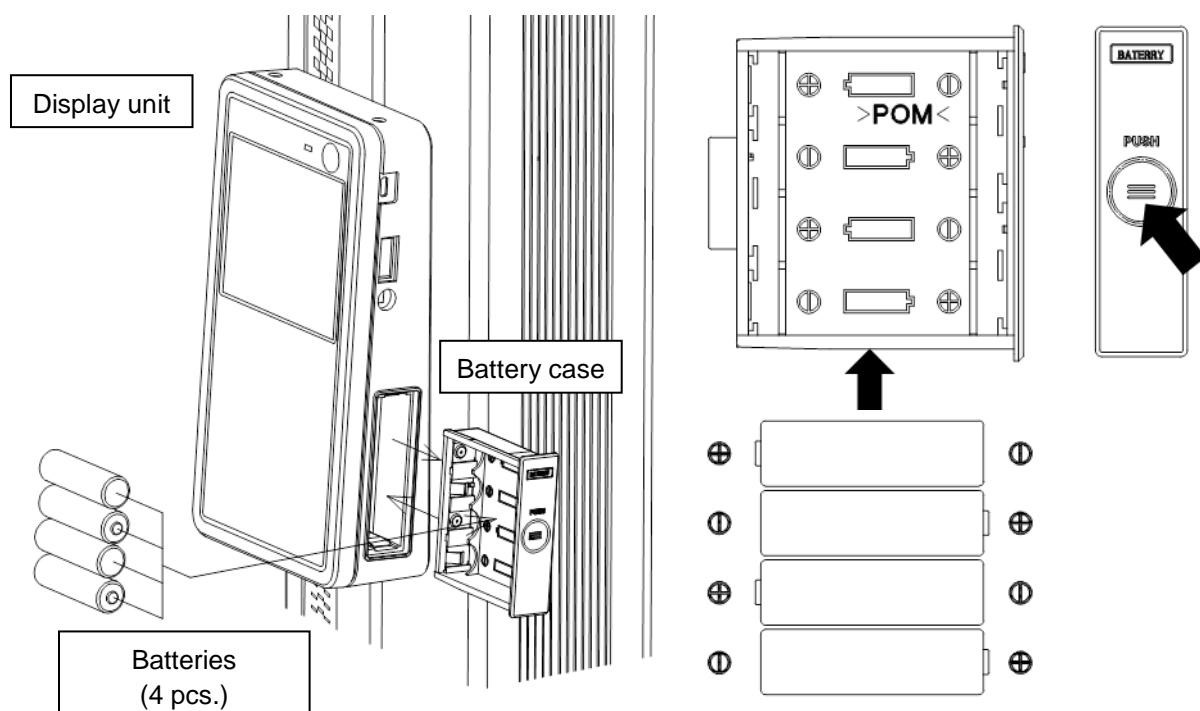
Fig.2

1.3.5   Attaching the probe   *1-11*

To use the supplied ø5 stepped probe, insert the probe into the probe holder opening in the main unit as far as possible, and then clamp it in place by tightening the probe clamp knob.
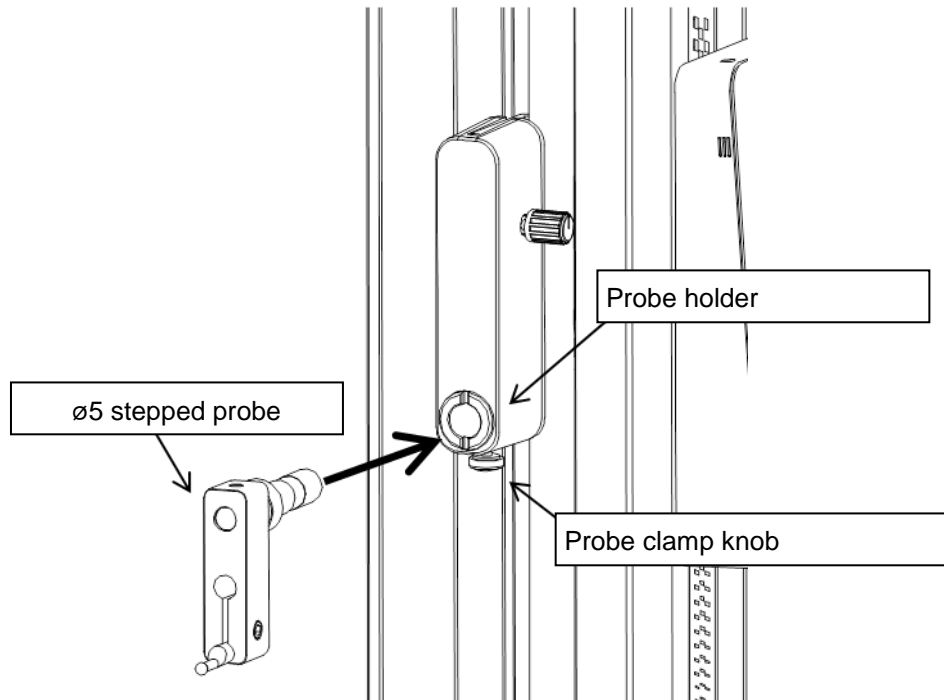
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2

OPERATION

This chapter explains the QM-Height practical operating procedure and gives actual measurement examples.

2.1   OPERATION

2.1.1   Moving and clamping the slider

The vertical movement of the probe can be made by operating the handle. Do not move the slider by holding the probe section. Failure to observe this may decrease the performance of this unit. When bringing the probe into contact with a surface plate or a workpiece, move the slider gently. Both rough and fine movements are available with the handle operation depending on the purposes.

Fine move

Clamp knob

Coarse move

Probe up/down handle
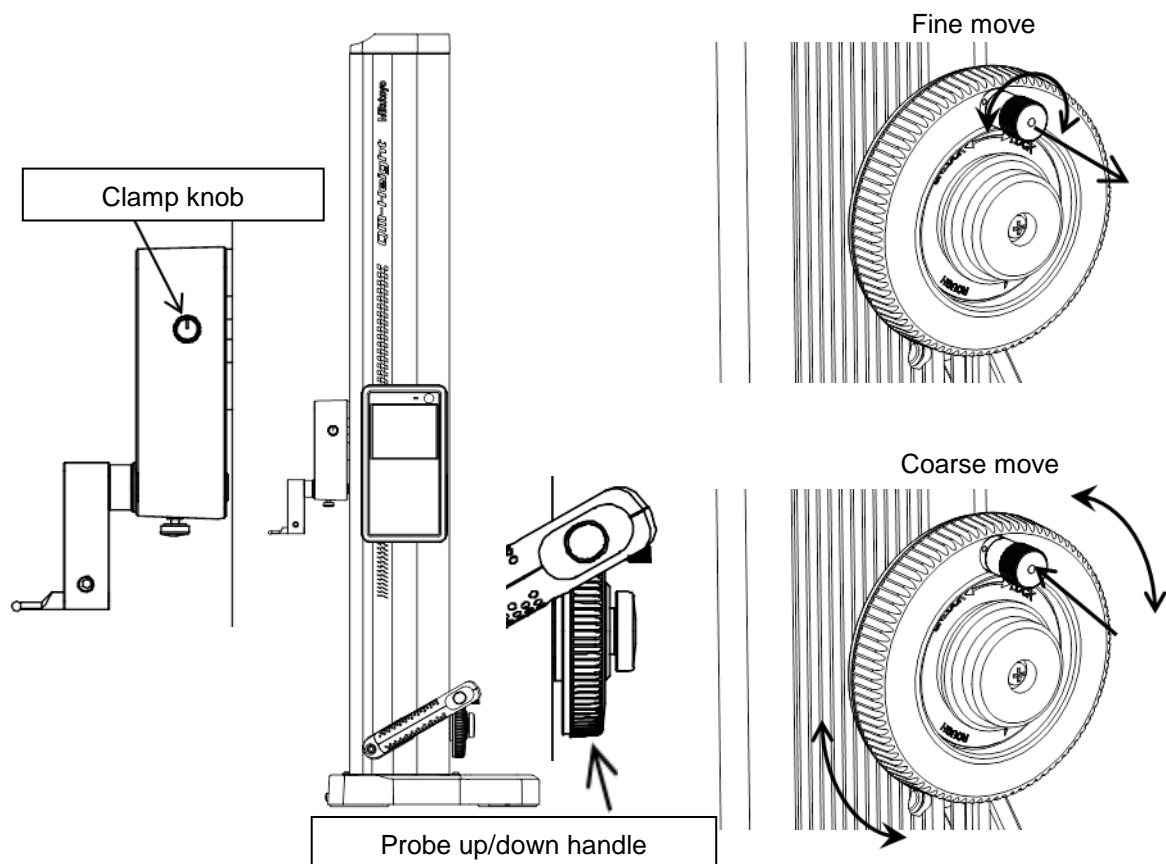
2.1.2 Sliding the main unit

- For models without air float function
  To slide the main unit on a surface plate during measurement, hold the base with your right hand and hold the grip with your left hand referring to the following figure.

Base (right hand)

Grip (left hand)
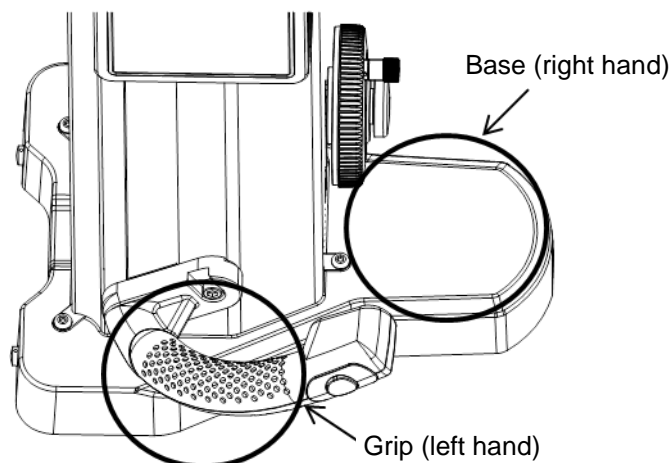
- For models with air float function
  If moving the main unit on the surface plate during measurement, pressing the switch provided on top of the grip shown in the figure below, reduces the friction between the base and surface plate and makes it possible to move the main unit smoothly. Air continues to be supplied from the internal pump while the switch is pressed, which causes floating state, and the air supply stops when the switch is released, which cancels the floating state.

Floating switch
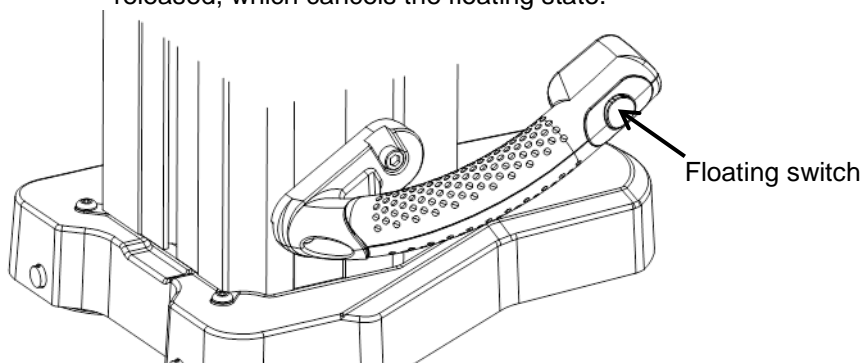
Important
1. Moving the main unit by holding a part other than the base or the grip may adversely affect the measuring accuracy and the instrument. Absolutely avoid holding a part other than the base.
2. The air float is an auxiliary function to facilitate transferring the main unit. Do not perform measurement with the air floating activated. When moving the main unit using the floating function, clean the surface plate in advance.
3. To use models equipped with the air float function, use the surface plate of JIS1 Class or above. If it is used on a scratched or bumpy surface, the designated performance may not be provided. Make sure to use a rigid surface plate. If there is flexure subjected to its own weight, the unit may not be floated.
4. If the low power source voltage alert is shown in the display unit, the air floating function cannot be used. Replace with the new battery.

2.1.3   Adjusting the floating amount

Adjust the airflow by rotating the float amount adjusting screw indicated below, if moving the base cannot be done easily because it is not floating apart from the surface plate even the air float function is activated. Use a flat-blade screwdriver according to the installation place to adjust the airflow.
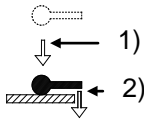

Flow volume +

Flow volume -

Float amount adjusting screw
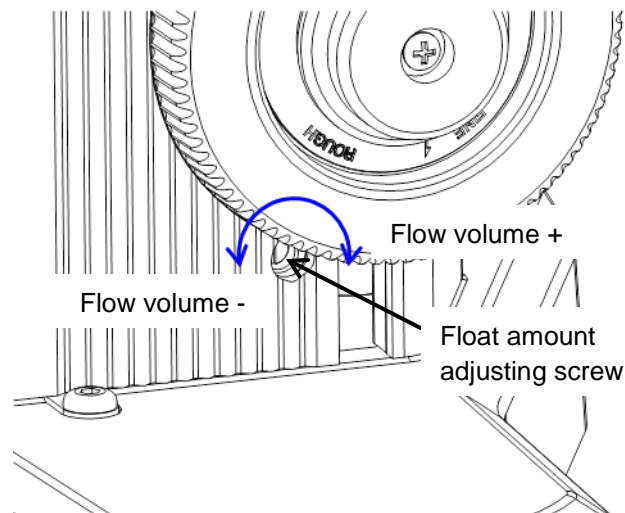
Important	1.	The unit has been adjusted to provide optimal performance before shipment. It is recommended to use the unit keeping the state of shipment as much as possible.
	2.	Be aware that excessive increase in the airflow may consume the feed pump, main unit of the product, and battery. According to the characteristic of the air float mechanism, the variation of the air flow may generate vibration of the main unit. In such a case, reduce the air flow.
	3.	If the airflow is adjusted, make sure that the friction between the surface plate and product is reduced.

2.2 Measurement Preparation

2.2.1 Setting the ABS origin

• To set the ABS origin:

	Procedure	State	Display content
1	Press the [PRESET] button. The PRESET symbol on the LCD starts blinking. Confirm that "+000.000mm" is displayed on the upper column. (If numbers other than zero are displayed, use the buttons to set the value to "+000.000mm". [Refer to "2.2.3 Presetting procedure".)	–	ABS PRESET mm +000.000
2	1. Move down the probe until it comes into contact with the surface plate. 2. When the probe comes into contact with the surface plate, slowly move down the probe until the buzzer sounds. The ABS origin setup is complete when the counter starts counting.	1) 2)	ABS mm 0.071

• To set the INC origin:

	Procedure	State	Display content
1	Press the [ZERO/ABS] button. The INC symbol on the LCD starts blinking. The INC origin will be set by operating the same procedure described in 2-2. of the ABS origin setting.	–	INC mm 0.000

Important
• When bringing the probe into contact with a surface plate (or a workpiece) be sure to make a gentle contact of the probe. Rough contact may cause an origin setup error.
• If the temperature environment has changed, set the ABS origin again.

TIP
• For information about the ABS origin setup using a gauge block, refer to section 2.2.3 "Presetting procedure".

• What is the ABS origin?

Usually a workpiece to be measured has a reference. The dimensions of the workpiece in drawings are based on the reference. Therefore, the measurement values are obtained from the reference and are used as the measurement results. The QM-Height performs measurement by setting the reference to an origin. After an origin has been set, a coordinate value from the origin becomes the height measurement data.

There are two possible "origins" with this unit as follows:

A) The "ABS origin" becomes the reference of a measuring machine, in which ABS measurement system is employed.

B) The "INC origin" becomes the relative reference from the ABS origin, in which INC measurement system is employed.

Use one of the origins according to the measurement purpose.

(A) ABS origin

(B) INC origin

Measuring position
Coordinate: Z
Workpiece
ABS origin
Surface plate

Measuring position
Coordinate: Z
Workpiece
INC origin
Surface plate
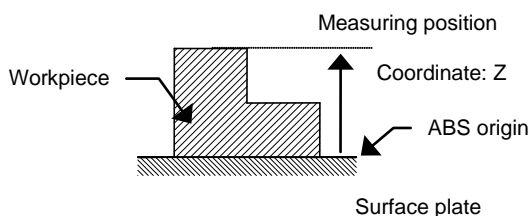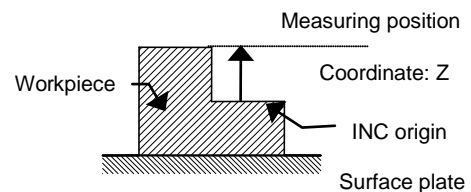
(A) ABS Origin

The ABS origin is set on the surface plate where the QM-Height is installed. Measurement results are basically coordinate values from this origin. Therefore, always set up the ABS origin prior to measurement. Also, if the measurement environment or the probe is changed, set the ABS origin again.

(B) INC Origin

The INC origin is used for obtaining a coordinate from the reference on a workpiece.

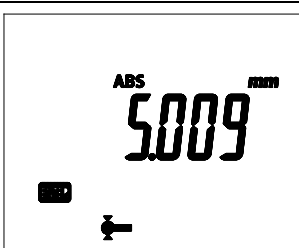• Switching between ABS measurement system and INC measurement system
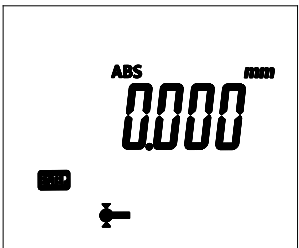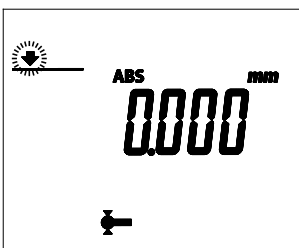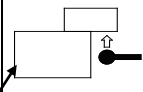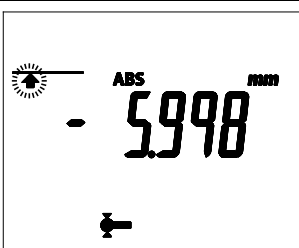
If [ZERO/ABS] is held down in the INC measurement system, the ABS measurement system is restored. The moving amount from the ABS origin that was specified last time will be displayed.

If [ZERO/ABS] is pressed in the ABS measurement system, the reference setting in the INC measurement system is activated and the INC symbol on the LCD blinks. Measurement can be started in the INC measurement system after the probe is contacted to a workpiece and the INC origin is set.

2.2.2 Setting up the probe

- Setting the probe allows this unit to perform measurements in a mixed procedure of upward and downward measurements.
  If using the QM-Height for the first time or the probe is changed, setup the probe.

- To set up a probe

	Procedure	State	Display content
1	Press the [MODE] button. Setup 1 on the LCD starts blinking. In this state, press the [button]. The current value will be displayed. Press the [ENTER] button to start the setting.	–	ABS **0.000** mm (*1)
2	Bring the probe into contact (in the downward) with the ball diameter calibration block as shown in the figure. (Lower the probe until the buzzer sounds.)	(*2)	ABS **0.000** mm
3	Bring the probe into contact (in the upward) with the ball diameter calibration block as shown in the figure. (Raise the probe until the buzzer sounds.) Ball diameter calibration block		ABS **- 5.998** mm
4	Ball diameter setup has been completed. Pressing the [CANCEL] button will restore the normal counting sate.	–	ABS **5.009** mm

(*1) If the probe has been already set, the compensation value is displayed.
(*2) For probe setting, use a supplied ball diameter calibration block. If using a gauge block, use the one with a height of 20mm or more.

> **Important** • Once the probe has been setup, the measurement result will be displayed after calculating the ball diameter compensation. Therefore, when the probe touches the workpiece, the display may appear to blink once, but it's not a malfunction.

2-6

2.2.3 Presetting procedure

1) To set an given value as an origin, perform presetting.
   (Example) Set an origin at 25.000mm, as an example.

	Procedure	Display content
1	Press the [PRESET] button to display the most recent preset value on the LCD, making the PRESET symbol blink. In this state, the plus/minus sign and shift can be changed with the right/left cursor buttons, and the numbers can be incremented/decremented (switching plus/minus) with the up/down cursor buttons.	ABS PRESET mm ✦ 000.000
2	Press the [⇨] button to blink the "+" or "-" sign. If the [⇧][⇩] button is pressed at this time, the sign can be switched between "+" and "-".	ABS PRESET mm ✦ 000.000
3	Press the [⇨] button to move the blinking digit to the tens digit.	ABS PRESET mm ✦ 000.000
4	Each time the [⇧] button is pressed, the blinking digit changes to 0, 1, 2, ... 8, 9, and 0. Press the button twice to display "2".	ABS PRESET mm ✦ 020.000
5	Display "5" in the unit digit in the same procedure as steps 3 and 4.	ABS PRESET mm ✦ 025.000

2) To set a registered preset value as an origin
   (Example) When 25.000mm has been set

	Procedure	Display content
5'	Press the [PRESET] button. The value "25.000mm" will be displayed, and the PRESET symbol blinks in the upper right of the LCD.	ABS PRESET mm ✦ 025.000

↓

	Procedure	Display content
6	Bring the probe directly into contact with the 25mm reference block. The PRESET symbol goes off, indicating that presetting has been completed. (In the measurement in which a test indicator or a dial indicator is used, the PRESET symbol goes off and the preset is complete when the [ENTER] button is pressed with the indicator is in contact with a 25mm reference block.)	ABS mm ✦ 025.000 z

> **Important** • When bringing the probe into contact with a surface plate (or a workpiece) be sure to make a gentle contact of the probe. Rough contact may cause an origin setup error.

2.3 Measurement (basic operation)

2.3.1 Height measurement

- This section gives two examples of height measurement procedures.
  Height measurement is categorized into the following two types.

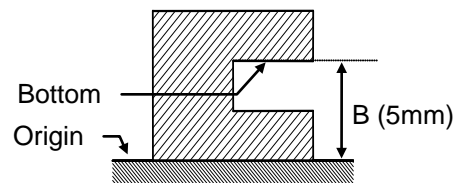 Top surface measurement: Measures the height of a top surface on a workpiece from the origin.
  Bottom surface measurement: Measures the height of a bottom surface on a workpiece from the origin.

NOTE	• This measurement example is described employing the ABS measurement system. Perform measurement preparation beforehand. (Refer to "2.2 Measurement Preparation".)

(Example1)

Top

A (5mm)

Origin

(Example2)

Bottom

Origin

B (5mm)
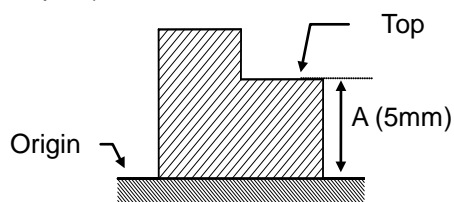
- Measure the height of the top surface on the workpiece.

- Measure the height of the bottom surface on the workpiece.

(Example 1) To measure the top surface height

	Procedure	State	Display content
1	Confirm that the ABS symbol on the LCD is lit.	—	ABS 6.892 mm
2	Move the probe above the top surface of the workpiece. Then slowly lower the probe until the buzzer sounds.		

(Example 2) To measure the bottom surface height

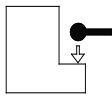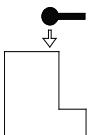|	Procedure	State	Display content
1	Confirm that the ABS symbol on the LCD is lit.	—	ABS 3.786 mm
2	Move the probe below the bottom surface of the workpiece. Then slowly raise the probe until the buzzer sounds.		
3	If measurement is successfully complete, the "H" symbol on the LCD is lit and measurement result will be displayed. (If an external output device is connected, data will be output.)	—	Bottom surface / Top surface H ABS 5.000 Z mm
4	Bring the probe out of contact with the workpiece. The counter returns to normal counting.	—	—
5	To perform this measurement continuously, repeat the procedure from step 2.	—	—

2.3.2 Step measurement

• This section gives two examples of step measurement procedures.

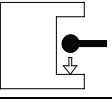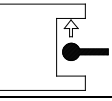| NOTE	• Perform measurement preparation beforehand. (Refer to "2.2 Measurement Preparation".)

(Example1)

(a2)

A (20mm)

(a1)

Origin
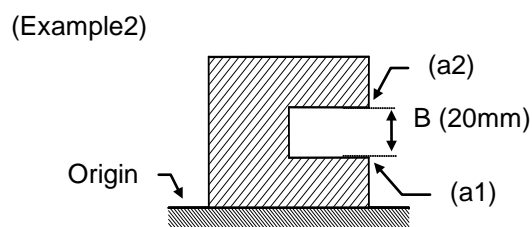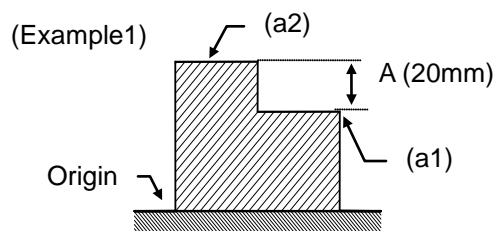
• Measure the step "A".

(Example2)

(a2)

B (20mm)

(a1)

Origin

• Measure the inside width "B".

(Example1) To measure step "A"

	Procedure	State	Display content
1	Press the [ZERO/ABS] button. The INC symbol on the LCD starts blinking.	–	INC 0.000 mm
2	Move the probe above the (a1) surface, and then slowly lower the probe onto the (a1) surface until the buzzer sounds.		
3	Move the probe above the (a2) surface, and then slowly lower the probe onto the (a2) surface until the buzzer sounds.		INC 39.524 mm

(Example2) To measure inside width "B"

	Procedure	State	Display content
1	Press the [ZERO/ABS] button. The INC symbol on the LCD starts blinking.	–	INC 0.000 mm
2	Move the probe above the (a1) surface, and then slowly lower the probe onto the (a1) surface until the buzzer sounds.		
3	Slowly raise the probe to the (a2) surface until the buzzer sounds.		INC 15.628 mm
4	If measurement is successfully complete, the "H" symbol on the LCD is lit and measurement result will be displayed. (If an external output device is connected, data will be output.)	–	H INC 20.000 Z mm
5	To perform this measurement continuously, repeat the procedure from step 1.	–	–

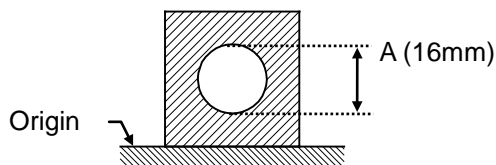| Important	• If "INC" is blinking, the counter is not counting. Counting will be started after zero-setting with the probe being in contact with a surface.

2.3.3 Inside diameter measurement

- This section gives an example of the inside diameter measurement procedure.

| NOTE | • Perform measurement preparation beforehand. (Refer to "2.2 Measurement Preparation".) |

(Example)

Origin

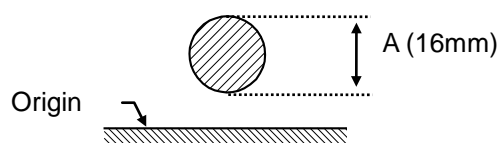A (16mm)

- Measure the inside diameter "A".

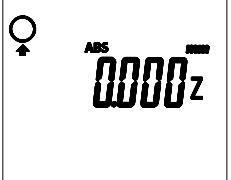|	Procedure	State	Display content
1	Press the ⬚ button. The ⬍ symbol on the LCD lights up, and the down arrow indicating the contacting direction will blink.	—	⬍ ABS 0.000 z
2	Slowly lower the probe toward the vicinity of the bottom peak of ID until the buzzer sounds, and then hold the handle at the position by hand or with the clamp screw.	⬇	
3	Holding the handle, move the workpiece or the main unit to search for the minimum point.		⬍ ABS -0.967 z
4	Press the ENTER button at the point where the count value does not change anymore. The up arrow indicating the contacting direction will blink.		
5	Slowly raise the probe toward the vicinity of the upper peak of ID until the buzzer sounds, and then hold the handle at the position by hand or with the clamp screw.	⬆	⬍ ABS 11.000 z
6	Holding the handle, move the workpiece or the main unit to search for the maximum point.		⬍ ABS 16.000 z
7	Press the ENTER button at the point where the count value does not change anymore.		
8	The measurement result will be displayed. (If an external output device is connected, data will be output.)	—	⬍ ABS 16.000 z_D
9	To perform this measurement continuously, press the ENTER button and repeat the procedure from step 1.		

2.3.4 Outside diameter measurement

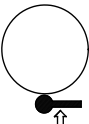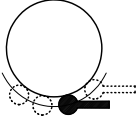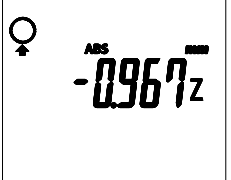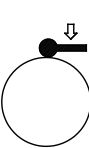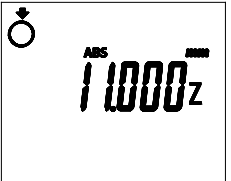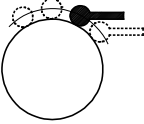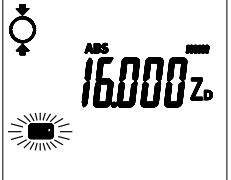- This section gives an example of the outside diameter measurement procedure.

| NOTE | • Perform measurement preparation beforehand. (Refer to "2.2 Measurement Preparation".) |

(Example)

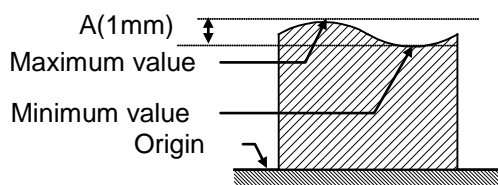A (16mm)

Origin

- Measure the outside diameter "A".

	Procedure	State	Display content
1	Press the ⬚ button. The ⬚ symbol on the LCD lights up, and the up arrow indicating the contacting direction will blink.	–	ABS mm 0.000 Z
2	Slowly raise the probe toward the vicinity of the bottom peak of OD until the buzzer sounds, and then hold the handle at the position by hand or with the clamp screw.		
3	Holding the handle, move the workpiece or the main unit to search for the minimum point.		ABS mm -0.967 Z
4	Press the ENTER button at the point where the count value does not change anymore. The down arrow indicating the contacting direction will blink.		
5	Slowly lower the probe toward the vicinity of the upper peak of OD until the buzzer sounds, and then hold the handle at the position by hand or with the clamp screw.		ABS mm 1.000 Z
6	Holding the handle, move the workpiece or the main unit to search for the maximum point.		ABS mm 16.000 Z
7	Press the ENTER button at the point where the count value does not change anymore.		
8	The measurement result will be displayed. (If an external output device is connected, data will be output.)	–	ABS mm 16.000 ZD
9	To perform this measurement continuously, press the ENTER button and repeat the procedure from step 1.		

2.3.5 Plane scanning measurement, minimum height measurement, maximum height measurement

This section gives an example of the plane scanning measurement procedure.

(Example)

A(1mm)
Maximum value
Minimum value
Origin

• Measure the displacement of the surface.

	Procedure	State	Display content
1	Press the [⇌] button. The [⇌] indication on the LCD lights up, and the up/down arrows indicating the contacting direction will blink.	–	
2	Slowly lower the probe toward the top surface until the buzzer sounds, and then hold the handle at the position by hand or with the clamp screw. (The up/down arrows light up.) * A bottom surface can also be measured in the same way.		ABS mm 0.000 Z
3	Holding the handle, move the workpiece or the main unit to search for the maximum/minimum points.		ABS mm 0.907 Z
4	Press the [ENTER] button at the point where the count value does not change anymore.		
5	The measurement result will be displayed. Pressing the [⇑] [⇓] button at this point will switch the measurement result display. Upper column: displacement range, minimum height measurement, maximum height measurement Lower column: difference between the previous measurement result and the center value in the displacement range (If an external output device is connected, data will be output.)	–	ABS mm 1.000 W Displacement range:W Minimum height:Zs Maximum height:ZL
6	To perform this measurement continuously, press the [ENTER] button and repeat the procedure from step 1.	–	

Important • Perform the plane scanning measurement within approximately 1mm range from the probe contacting point. (Measurement exceeding this range may increase the error.)

1mm
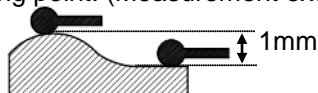
2.4 Measurement (applied operation)

2.4.1 Calculating point-to-point distance

• This unit automatically calculates the difference between the current value and last measurement value at every measurement.

NOTE	•	Perform measurement preparation beforehand. (Refer to "2.2 Measurement Preparation".)

(Example) Sequentially calculate the distances between "a1" and "a2" (20 mm) and between "a2" and "a3" (22 mm).
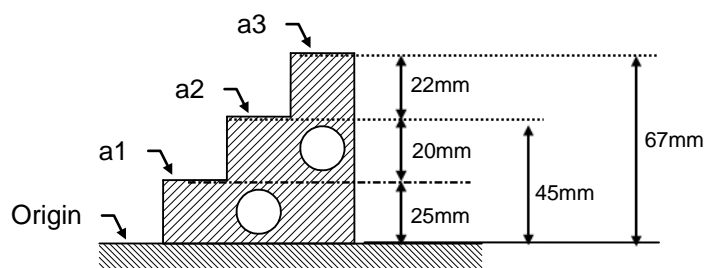
• Determine a point-to-point distance.

	Procedure	Display content
1	Measure "a1" referring to 2.3.1 Height measurement".	25.000 z 25.000 z▸
2	Measure "a2" in the same way. The distance between 2 points will be displayed on the lower column of the LCD.	45.000 z 20.000 z▸
3	Measure "a3" in the same way. The distance between 2 points will be displayed on the lower column of the LCD.	67.000 z 22.000 z▸

2.4.2

Memorizing measurement data

• This section describes how to memorize measurement data.

With this unit, arbitrary two points in the height measurement result of each measurement can be memorized.

The memorized two points will be maintained unless power cord is disconnected, and distance between two points can be calculated anytime.

NOTE	• Perform measurement preparation beforehand. (Refer to "2.2 Measurement Preparation".)

(Example) After the composite measurement, determine the distance between 2 points (25mm); the height at the center of circle S2 and a1.
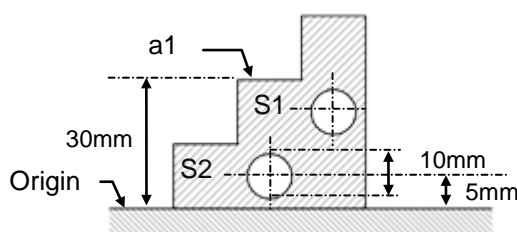
• Save the measured data.

	Procedure	Display content
1	Measure "a1" referring to 2.3.1 Height measurement.	
2	Hold down [button] for 1 sec. or more until the buzzer sounds while the measured value of "a1" is displayed. M1 on the LCD lights up and the measurement result will be saved in [Memory 1].	30.000 Z M1
3	Measure the inside diameter of S2 referring to "2.3.3 Inside diameter measurement".	
4	Hold down [button] for 1 sec. or more until the buzzer sounds while the measured value of S2 is displayed. M2 on the LCD lights up and the center height of S2 (A:5mm) will be saved in [Memory 2].	10.000 Zᴅ M2

• Determine a point-to-point distance.

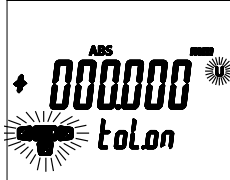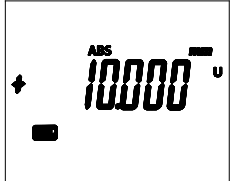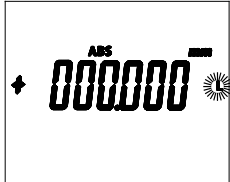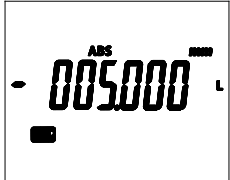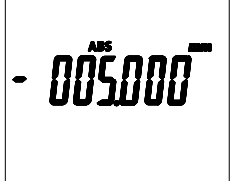|	Procedure	Display content
1	During the normal height measurement, press the [MODE] button twice. The "M1-M2" on the LCD starts blinking. In this state, press the [button] button. The distance between "a1" height and the center height of S2 will be displayed on the LCD.	25.000 Z M1-M2

TIP	• When the [button] button is pressed while point-to-point distance is displayed, M1/M2 on the LCD lights up, and the divided results will be displayed. Utilize those results effectively, since they can be used for calculating the ratio of measured data or more. • When the memory values are not saved, "M1,M2,M.CLR" are not displayed on LCD. • To clear the memory values, refer to "3.2.5 Memory calculation".

2.4.3　Tolerance judgment

• This section describes the procedure for performing tolerance judgment.

(Example) To set an upper limit 10.000mm, and lower limit -5.000mm.

	Procedure	Display content
1	Press the [MODE] button. The "TOL." on the LCD starts blinking. In this state, press the [⊕] button. The "U" symbol on the LCD will start blinking, and the previously set upper limit value will be displayed.	
2	Change the value to "10.000mm" by operating the buttons. Follow the same procedure as for the preset values. (Refer to "2.2.3 Presetting procedure".)	
3	Press the [ENTER] button to set the upper limit of tolerance. The "L" symbol will start blinking, and the previously set lower limit value will be displayed.	
4	Change the value to "-5.000mm" by operating the buttons. Follow the same procedure as for the preset values. (Refer to "2.2.3 Presetting procedure".)	
5	Press the [ENTER] button to set the lower limit of tolerance.	

- LCD tolerance judgment display

The tolerance judgment display on the LCD is enabled by setting the tolerance judgment. After the setup is complete, OK/NG judgment result will be displayed.

- The LED lights up as follows in the hold state, and they will be turned off when hold state is canceled.
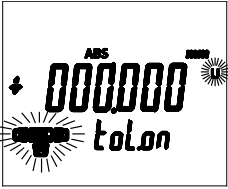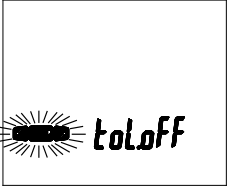
  GO: Lights in green.
  +NG: Lights in red.
  -NG: Lights in orange.

Follow the procedure below to set the on/off of the tolerance judgment display.

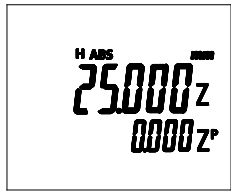• To switch on/off of tolerance judgment display

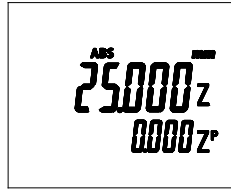|	Procedure	Display content
1	Press the [MODE] button. The "TOL." on the LCD starts blinking. In this state, press the [⊕] button. The "U" symbol on the LCD will start blinking, and "toL." will be displayed on the lower column. Select "toL. on (oFF)" with the ⟶ button.	
2	To set tolerance judgment display ON, select "toL. on" with ⟸ ⟹ buttons, and then press the [ENTER] button. The display will restore the normal counting state and display tolerance judgment.	
3	To set tolerance judgment display OFF, select "toL. oFF" with ⟸ ⟹ buttons, and then press the [ENTER] button. The display will restore the normal counting state and disable the tolerance judgment display.	

Important
- In the tolerance setting, be sure to set the upper limit value to a numeric value larger than the lower limit value. If the upper limit value is set to a numeric value smaller than the lower limit value, the LCD displays the tolerance setting error "Err-90t".
- Tolerance judgment values are retained in memory even if the power is turned off.
- LED lighting time can be specified in detail at mode setting. Refer to "3.2.6 Setting the power" for further information.

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2.4.4　Holding a display value and outputting measured data

- To hold a display value

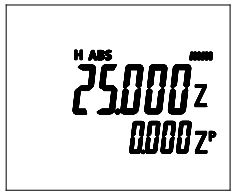|	Procedure	Display content
1	When the [HOLD DATA] button is pressed, the "H" symbol on the LCD lights up. In this state, the displayed value will be held even the probe is moved. To restart counting, press the [HOLD DATA] button again. The "H" symbol goes off. If the Digimatic mini-processor (e.g., DP-1VR) is connected, currently displayed data will be output and the hold state be canceled.	25.000 z 0.000 z°

- Measurement data output method. There are 2 different output methods.

	Procedure	Display content
1	Connect the Digimatic mini-processor (e.g., DP-1VR) to the Digimatic output connector of this product. Press the [HOLD DATA] button. The displayed data will be output.	25.000 z 0.000 z°
2	Bring the probe into contact with a workpiece. At this time, currently displayed data will be output.	

Important　Caution when performing inside diameter, outside diameter, plane scanning measurement
- Data output can be done only when the measurement result is displayed. Data output is disabled during scanning measurement. Normally, the measurement data displayed on the upper column of the LCD will be output.
- To set the LCD lower column output, follow the description in [3.2.4 Output setting].

TIP　• By performing the following operations, measurement result hold mode can be retained even if the probe is moved away from the workpiece.

	Procedure	Display content
1	Move the probe above the workpiece, and slowly lower the probe until the buzzer sounds, and then hold the handle at the position by hand or with the clamp screw ("H" symbol on the LCD is lit).	25.000 z 0.000 z°
2	Press the HOLD/DATA button. The measurement result of LCD is held and it will not be changed even if the probe is moved. Hold mode will not be released even if the data output request is performed from the external data processing device. At this moment, measurement result is updated each time after probe input is performed. To release the hold mode, press the HOLD/DATA button.	

2.5   When Problem Occurred

2.5.1   Troubleshooting

See the table below and troubleshoot before deciding that it is a machine failure. If the remedy does not work, contact our service department via your dealer for repair.

Symptom	Check	Remedy	Reference
The power is not turned on when the ⏻ button is pressed.	• Are batteries set correctly? • Is AC Adapter securely connected?	• Set the batteries correctly. • Reconnect the AC Adapter.	1.3.4
The battery runs down fast.	• Is LED set to always-on?	• Change the setting of the LED lighting.	3.2.6
Measurement is not executed even when the probe comes in contact with a workpiece. (The buzzer does not sound.)	• Is the clamp knob locked?	• Loosen the clamp knob.	1.2.1
Measurement results vary.	• Is the probe clamp knob loosened? • Is rough contact made when bringing the probe into contact with a workpiece?	• Tighten the probe clamp knob. • Make a gentle contact when bringing the probe into contact with a workpiece.	1.3.5 2.3.1
Displayed value on the LCD flickers.	• Does the flickering goes off when all connected cables and the AC Adapter are removed and when the unit is driven only with the batteries?	• The unit is influenced by external noises. Take antinoise measures.	1.3.1

2.5.2   Error message

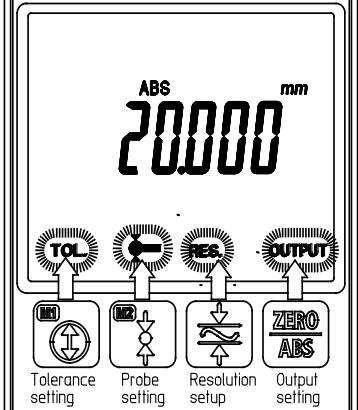| Error message	Error meaning	Remedy	Reference
🔋	Warning of decrease in power supply voltage • The battery is exhausted.	• Replace the battery with new one. • Connect an AC Adapter (option).	1.3.4
Err-30F	Overflow error • The value to be displayed exceeds the displayable digit number.	• When the value falls into the displayable digit number, this error will be automatically canceled.	2.2.3
XXX.XXE (X: given value) Err-48A	Counting error • Positioning detection sensor error (ex.: foreign substance has entered, misalignment caused by an impact)	• The sensor may have a failure. If display is not restored even when the slider is stopped, contact the nearest Mitutoyo sales office/service center.	-
Err-90t	Tolerance value setting error • The upper limit value is set smaller than the lower limit value.	• Set the tolerance values as the upper limit value becomes larger than the lower limit.	2.4.3
Err-96P	Probe setting error • Invalid value is set for the probe diameter	• Negative value is set for the probe diameter. Retry the probe setting.	2.2.2

3

MODE SETTING

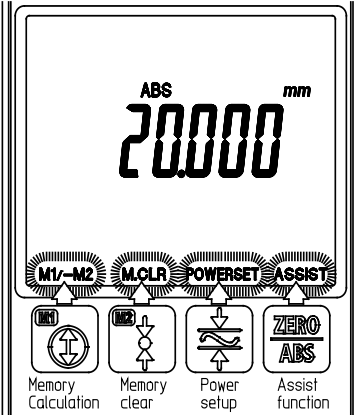This chapter describes the mode settings.

3.1　Mode Setting

3.1.1　How to enable mode setting

In the mode setting, the resolution, output, and power supply can be set. Also setup and execution of assist function are available with this machine.

- To set tolerance, probe, resolution, and output

	Procedure	Display content
1	Press the [MODE] button. The "Setting1" blinks.	
2	Press the button provided directly below the item to be set up. • To set the resolution, press the [⇌] button. → [Refer to "3.2.3 Resolution setup".] • To set up the output, press the [ZERO/ABS] button. → [Refer to "3.2.4 Output setting".]	

- To set memory/clear, power, and assist function setup and execution

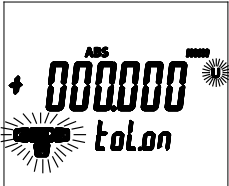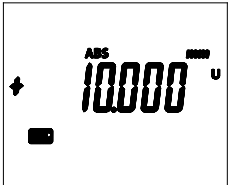|	Procedure	Display content
1	Press the [MODE] button twice. The "Setting2" blinks.	
	Press the button provided directly below the item to be set up. •To set up the power, press the [⇌] button. → [Refer to "3.2.6 Setting the power".] •To set up the assist function, press the [ZERO/ABS] button. → [Refer to "3.2.7 Assist function (setup and execution)".]	

- Default settings

Setting1	Upper/lower limit values [000.000 mm]	Scanning complete setting [Manual]	Resolution [0.001 mm] [0.00005 in]	Data output column [Upper column] Digimatic output digits (only for inch system models) [Last 6 digits]
Setting2	Memory value 1, 2 [000.000 mm]		Auto-off time [2 min.] LED lighting [Lights for 3 sec.]	Assist [All "-"]

3.2   Various Modes

3.2.1   Tolerance setting

- This section describes the procedure for performing tolerance judgment.

(Example) To set an upper limit 10.000mm, and lower limit -5.000mm.
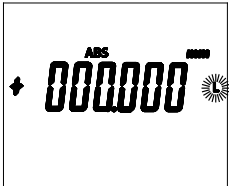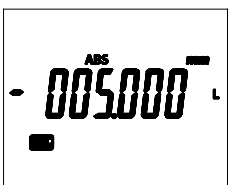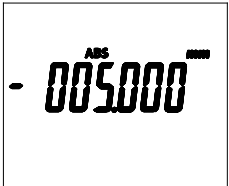
	Procedure	Display content
1	Press the [MODE] button. The "TOL." on the LCD starts blinking. In this state, press the button. The "U" symbol on the LCD will start blinking, and the previously set upper limit value will be displayed.	
2	Change the value to "10.000mm" by operating the buttons. Follow the same procedure as for the preset values. (Refer to "2.2.3 Presetting procedure".)	
3	Press the [ENTER] button to set the upper limit of tolerance. The "L" symbol will start blinking, and the previously set lower limit value will be displayed.	
4	Change the value to "-5.000mm" by operating the buttons. Follow the same procedure as for the preset values. (Refer to "2.2.3 Presetting procedure".)	
5	Press the [ENTER] button to set the lower limit of tolerance.	

● LCD tolerance judgment display

The tolerance judgment display on the LCD is enabled by setting the tolerance judgment. After the setup is complete, OK/NG judgment result will be displayed.

•   The LED lights up as follows in the hold state, and they will be turned off when hold state is canceled.
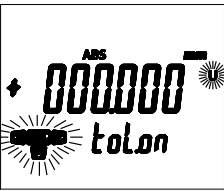
GO: Lights in green.
+NG: Lights in red.
-NG: Lights in orange.

Follow the procedure below to set the on/off of the tolerance judgment display.

• To switch on/off of tolerance judgment display

	Procedure	Display content
1	Press the 【MODE】 button. The "TOL." on the LCD starts blinking. In this state, press the 【⊕】 button. The "U" symbol on the LCD will start blinking, and "toL." will be displayed on the lower column. Select "toL. on (oFF)" with the ___ button.	
2	To set tolerance judgment display ON, select "toL. on" with 【⇐】 【⇒】 buttons, and then press the 【ENTER】 button. The display will restore the normal counting state and display tolerance judgment.	
3	To set tolerance judgment display OFF, select "toL. oFF" with 【⇐】 【⇒】 buttons, and then press the 【ENTER】 button. The display will restore the normal counting state and disable the tolerance judgment display.	

Important   •   In the tolerance setting, be sure to set the upper limit value to a numeric value larger than the lower limit value. If the upper limit value is set to a numeric value smaller than the lower limit value, the LCD displays the tolerance setting error "Err-90t".

•   Tolerance judgment values are retained in memory even if the power is turned off.

•   LED lighting time can be specified in detail at mode setting. Refer to "3.2.6 Setting the power" for further information.

3.2.2 Probe setting

- Setting the probe allows this unit to perform measurements in a mixed procedure of upward and downward measurements.
  If using the QM-Height for the first time or the probe is changed, setup the probe.

- To set up a probe

	Procedure	State	Display content
1	Press the [MODE] button. Setup 1 on the LCD starts blinking. In this state, press the [ ] button. The current value will be displayed. Press the [ENTER] button to start the setting.	–	(*1)
2	Bring the probe into contact (in the downward) with the ball diameter calibration block as shown in the figure. (Lower the probe until the buzzer sounds.)	(*2)	
3	Bring the probe into contact (in the upward) with the ball diameter calibration block as shown in the figure. (Raise the probe until the buzzer sounds.) Ball diameter calibration block		
4	Ball diameter setup has been completed. Pressing the [CANCEL] button will restore the normal counting sate.	–	

(*1) If the probe has been already set, the compensation value is displayed.
(*2) For probe setting, use a supplied ball diameter calibration block. If using a gauge block, use the one with a height of 20mm or more.

Important	•	Once the probe has been setup, the measurement result will be displayed after calculating the ball diameter compensation. Therefore, when the probe touches the workpiece, the display may appear to blink once, but it's not a malfunction.
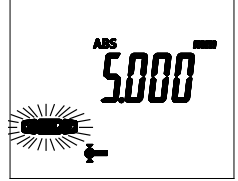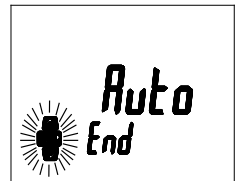
- Setting the probe scanning terminating operation allows the terminating method after the scanning operation to be selected at ID/OD measurement.
  Following operation is available:

  - **Manual termination**   The terminating operation is performed manually (press the [ENTER] button).
  - Automatic termination   When the probe moves upward approx. 0.5 mm from the lowest point, or moves downward approx. 0.5 mm from the highest point, the termination operation is automatically performed.

- To set the terminating operation of probe scanning

	Procedure	Display content
1	Press the [MODE] button. The symbol on the LCD starts blinking. In this state, press the button. The current termination setting will be displayed on the LCD when the [⇐] [⇒] buttons are pressed.	⌐5.000 (*1)
2	Display the desired setting with the [⇓] [⇑] buttons. ENTER↔Auto↔ENTER...	Auto End
3	Press the [ENTER] button. The displayed terminating method will be set.	25.000z

Important	•	When the automatic termination is selected, make sure to perform the scanning measurement so that the probe passes the lowest point or the highest point. Otherwise, proper measurement result will not be obtained.
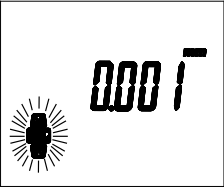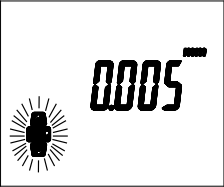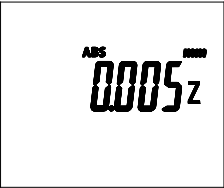
3.2.3　Resolution setup

- Specifying the minimum reading allows values to be displayed in a resolution suitable for applications. Following minimum readings are available:
    [Models with mm system] **0.001 mm**/0.005 mm
    [Models with inch system] **0.00005 in**/0.0001 in /0.0002 in

- To set the resolution

	Procedure	Display content
1	Press the [MODE] button. Setup 1 on the LCD starts blinking. In this state, press the [≋] button. The current resolution will be displayed.	*0.001*
2	Display the resolution by operating the [⇑][⇓] buttons. [Models with mm system] 0.001↔0.005↔0.001... [Models with inch system] 0.00005↔ 0.0001↔ 0.0002↔0.00005...	*0.005*
3	Press the [ENTER] button. The displayed resolution will be set.	*0.005z*
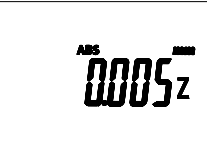
3.2.4   Output setting

This section describes how to select a Digimatic output data column and how to specify the output digits.

- Setting the output allows a Digimatic output data column to be selected.

Following output data columns can be set:
- **Upper column:**   Outputs the items in the upper column.
- Lower column: Outputs the items in the lower column.
- To specify the data column to be output
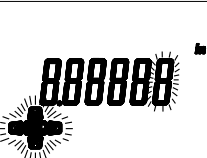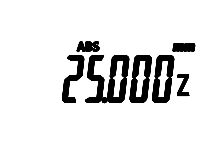
	Procedure	Display content
1	Press the [MODE] button. Setup 1 on the LCD starts blinking. In this state, press the [ZERO/ABS] button. The current setting of the output data column will blink on the LCD.	*123456*
2	By operating [↓][↑] buttons, blink the column whose data is desired to be output. Upper column↔Lower column↔Upper column...	*123456*
3	Press the [ENTER] button. The displayed column will be selected as the Digimatic output data.	*0.005 z*

- Setting the output allows the digit number of the Digimatic output to be changed.
  (Setting is available only for inch system models and resolution of "0.00005in".)
  Only the models with the inch system can be set, and following output digit number can be set:
  [Models with inch system]
      Last 6 digits output (ex. Outputs "2.12345 in" out of "22.12345 in")
      Outputs first 6 digits (ex. Outputs "22.1234 in" out of "22.12345 in")
- To set the output digits (only for inch system models)

	Procedure	Display content
1	Press the [MODE] button. Setup 1 on the LCD starts blinking. In this state, press the [ZERO/ABS] button. The data output column will blink on the LCD. Press the [←][→] buttons. The current setting of the output digit number will be displayed on the LCD.	*123456*

2	By operating [↑][↓] buttons, display the desired output digits (last or first 6 digits)
	    8.88888 ↔ 88.8888 ↔ 8.88888...
	  Last 6 digits First 6 digits Last 6 digits
		888888

3	Press the [ENTER] button. The displayed output digit number will be specified.	*25.000 z*

3.2.5 Memory calculation (calculation of point-to-point distance) and memory clear

This section describes the memory calculation (calculation of point-to-point distance) and memory clear.

- The memory calculation allows the point-to-point distance to be calculated.
  After saving the memory 1 and memory 2, perform the memory calculation.

- Determine a point-to-point distance.

Procedure	Display content
Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [⊕] button. The point-to-point distance will be displayed on the LCD.	ABS *20.000*z M1-M2

> **TIP** • When the button is pressed while point-to-point distance is displayed, M1/M2 on the LCD lights up, and the divided results will be displayed. Utilize those results effectively, since they can be used for calculating the ratio of measured data or more.

- Saved memory values can be cleared.

- Clear the Memory 1 and Memory 2.

Procedure	Display content
Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [🗑] button. M1 and M2 on the LCD will blink. Press the [ENTER] button. The Memory 1 and Memory 2 will be cleared.	cLEAr M1 M2

- Clear the Memory 1 (Memory 2).

Procedure	Display content
Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [🗑] button. M1 and M2 on the LCD will blink. Display M1 (M2) on the LCD by operating [⇐] [⇒] buttons. Press the [ENTER] button. Only the Memory 1 (2) will be cleared.	cLEAr M1

> **TIP** • When the memory values are not saved, "M1,M2,M.CLR" are not displayed on LCD.
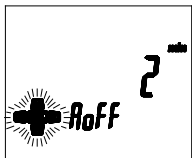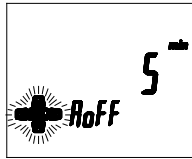
3.2.6 Setting the power

This section describes how to specify the auto-off time and how to specify the LED lighting time.

- Specifying the auto-off time allows setting the period until the power is automatically turned off after measurement.

Following auto-off times are available:
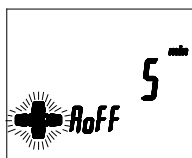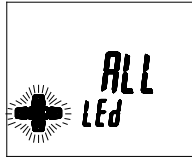
- **2 minutes** / 5 minutes / OFF (that deactivates the auto-off function)

- To set the auto-off time

	Procedure	Display content
1	Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [⬆⬇] button. The current auto-off time will be displayed on the LCD.	2 AoFF
2	Display the auto-off time by operating the [⬆][⬇] buttons. 2min↔5min↔OFF↔2min...	5 AoFF
3	Press the [ENTER] button. The displayed auto-off time will be specified.	25.000z 0000z'

- Specifying the LED lighting time allows the LED lighting time after tolerance judgment to be specified.

Following LED lighting times are available:

- **3 seconds lighting** (-> Off) / always-on / Off (LED does not light)

- To set the LED lighting time

	Procedure	Display content
1	Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [⬆⬇] button. The current auto-off time will be displayed on the LCD.	5 AoFF
2	Check the LED display on the LCD by operating the [⬅][➡] buttons.	3 SEc LEd
3	Display the LED lighting time by operating the [⬆][⬇] buttons. 3SEc↔ALL↔oFF↔3SEc...	ALL LEd
4	Press the [ENTER] button. The displayed LED lighting time will be set.	25.000z 0000z'

3.2.7　Assist function (setup and execution)

This section describes the assist function with which part programs can be registered and executed.
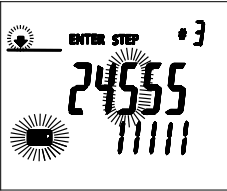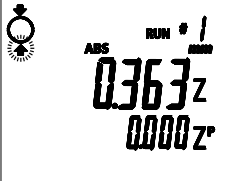
- Ten part programs can be registered in the registration feature of the assist function.
  The registrable measurement numbers and measurement functions are described in the table as follows:
- List of Measurement No. (Measurement function/Button to press)
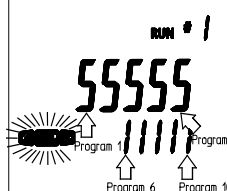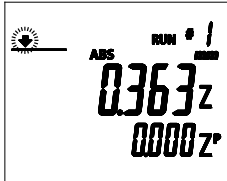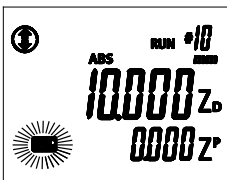
Measurement No.	Measurement function	Button to press	Measurement
Meas. 1	ID measurement		Measures the inside diameter.
Meas. 2	OD measurement		Measures the outside diameter.
Meas. 3	Plane scanning measurement		Measures displacement of the plane.
Meas. 4	Downward measurement		Measures the height of lower surface.
Meas. 5	Upward measurement		Measures the height of upper surface.

- To register the assist function

	Procedure	Display content
1	Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [ZERO/ABS] button. The measurement numbers currently registered in the assist function will be displayed on the LCD. The numbers of the part program 1 through 5 are displayed on the upper column from the left, and the part program 6 through 10 are displayed on the lower column from the left. [Ex.] If part programs 1 to 5 are upward measurements, and 6 to 10 are ID measurements, the LCD shows the display at right.	
2	Display ENTER STEP by operating the [←] [→] buttons. ENTER STEP↔RUN↔ENTER STEP...	

	Procedure	Display content
3	Press the [ENTER] button. The registration of the part program will be started. Press the button corresponding to the measurement function to be registered referring to the List of Measurement No. Every time the button is pressed, the corresponding part program (1 to 5) is displayed. Perform registered in sequence. • When registering the programs 1 through 9, press the [ENTER] button after registration. • To cancel a registered program, press the [CANCEL] button. At this time, reregistration is required since all the registered steps will be canceled.	ENTER STEP # 3 24555 11111
4	When registering 10 programs is complete, ENTER STEP on the LCD changes to RUN, and the assist function will be executed. Refer to No. 3 or later in the table below.	RUN # 1 ABS 0.363 Z 0.000 Zᴾ

• To execute the assist function

	Procedure	Display content
1	Press the [MODE] button twice. Setup 2 on the LCD starts blinking. In this state, press the [ZERO/ABS] button. The current assist measurement number will be displayed on the LCD.	ENTER STEP # 1 55555 11111
2	Display RUN by operating the [⇐] [⇒] buttons. ENTER STEP↔RUN↔ENTER STEP...	RUN # 1 55555 11111 Program 1 Program 5 Program 6 Program 10
3	Press the [ENTER] button. The assist function will be performed. Execution of registered part programs starts in sequence from the first part program.	RUN # 1 ABS 0.363 Z 0.000 Zᴾ
4	When the 10th part program is finished, the assist function will be terminated. Press the [ENTER] button if you wish to continue the measurement operation. To cancel the assist function, press the [CANCEL] button.	RUN # 10 ABS 10.000 Z_D 0.000 Zᴾ

MEMO

4 SPECIFICATIONS

This chapter describes specifications.

4.1 Digimatic Data Output Specification

4.1.1 Data format

Output order →

| d1 | d2 | d3 | d4 | d5 | d6 | d7 | d8 | d9 | d10 | d11 | d12 | d13 |

Decimal point
X.X.X.X.X.X.X
3(1100)
5(1010)

MSD Measured value LSD

All "F"
(1111)

Sign
$+:0(0000$
$-:8(0001)$

Unit

| mm | 0000 | inch: | 1000 |
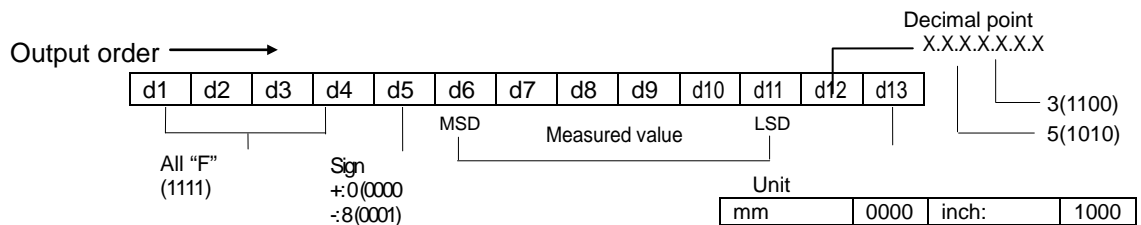
(Output example)

(Specification))

| "d1" | "d2" | "d3" | ⌠⌡ | "d13" |
| 2^0-2^1-2^2-2^3 | -2^0-2^1-2^2-2^3 | 2^0-2^1-2^2-2^3 | | -2^0-2^1-2^2-2^3 |
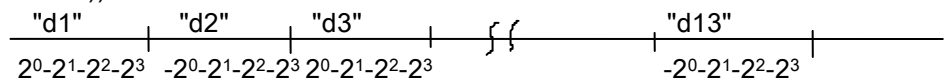
(Ex.) Normal measurement 0.123mm

| 1111 | 1111 | 1111 | 1111 | 0000 | 0000 | 0000 | 0000 | 1000 | 0100 | 1100 | 1100 | 0000 |
| F | F | F | F | + | 0 | 0 | 0 | 1 | 2 | 3 | 3 | mm |
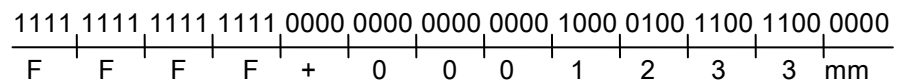
TIP • Since data at a resolution of 0.00005in has seven effective digits, all the digits cannot be outputted at once in the Mitutoyo SPC Digimatic Output specifications. Therefore, this gage usually outputs six digits of data, discarding the 10in-digits (most significant digit). However, depending on the setup, the gage can output the most significant digit. (In this case, the output of up to 99.9999 in is available.)
To do so, change the setting as appropriate. [Refer to "3.2.4 Output setting".]

4.1.2 Connector specification
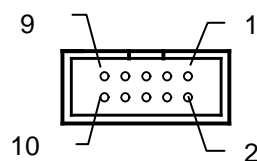
Pin No	I/O	Signal name
1,10	—	GND
2	O	DATA
3	O	CLOCK
4	O	RD
5	I	REQ
6-9	—	(Not used)

Vceo=35(V)
Ic=200(mA)

3.3(V)
22k(Ω)
CMOS
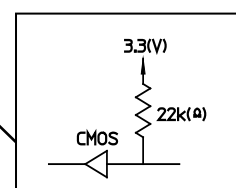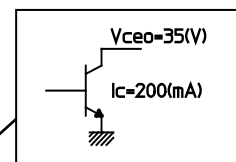
4.1.3 Timing chart
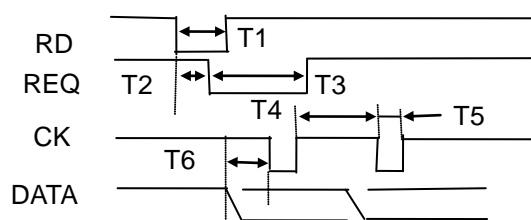
T1	2sec(max)
T2,T3	Differs according to the connected device.
T4	430us(Typ.)
T5	200us(Typ.)
T6	200us(Typ.)

4.2 USB Data Output Specification

4.2.1 Communication protocol

Communication method	Half-duplex communication
Communication speed	9600 bps
Start bit	1
Data bit	8
Parity bit	None
Stop bit	1

4.2.2 Data format

D1	Code No. "0" (fixed)
D2	Channel No "1" (fixed)
D3	Measurement item "A" (fixed)
D4	Sign "＋" or "－"
D5 - D12	DATA (floating decimal point)
D13	Carriage return

4.2.3 Connector specification

Pin No.	Signal name	Definition
1	Vbus	Power supply (5V) from the PC
2	D-	Communication with PC (-)
3	D+	Communication with PC (+)
4	N.C.	Connected to signal GND
5	GND	Signal GND

4.2.4 Data format examples

Unit system	Resolution	Output format
mm	0.001	0.123 → "01A+0000.123[CR]"
	0.005	0.125 → "01A+0000.125[CR]"
inch	0.00005	0.12345 → "01A+00.12345[CR]"
	0.0001	0.1234 → "01A+000.1234[CR]"
	0.0002	0.1234 → "01A+000.1234[CR]"

- Installation of the dedicated driver to the PC allows this unit to communicate with the PC via USB. Before connecting between this unit and a PC, install the dedicated driver.
- Also, using Mitutoyo's input tool will make it possible to output data by Windows standard driver.

The dedicated driver can be operated on Windows OSes.
This document is written based on the premise that the user understands how to operate the Windows-based software. If you are not familiar with operation of the Windows, refer to the operating instructions of the Windows such as "Microsoft Windows First Step Guide".

This document describes how to operate the software on Windows XP, but the functions and operations of this software should not vary with versions of Windows.

Microsoft, Windows, Windows Vista, and Excel are either a registered trademark or a trademark of Microsoft Corporation in the United States and/or other countries.

4.2.5   How to install dedicated driver

- Install the dedicated driver to the PC.
  Before installation, make sure that your PC meets the system requirements.

Items	System Environments
OS	Windows 8 / Windows 7 Windows Vista / Windows XP SP2 or later
HDD capacity	500KB or more
Display	800x600 dots or more, 256 colors or more
Other	• Communication software required • USB port standard for the main unit recommended Other USB port not guaranteed • Internet access required

- Start up the PC.
- Download the dedicated software from the Web site described below after connecting the Internet.
  http://www.mitutoyo.co.jp
  Checking of download destination

- Install the dedicated driver.

4.2.6   PC connection and measurement data transfer

Start up the PC in advance.

- Connect this unit and the PC.
  Connect between this unit and the PC with use of a commercially available communication USB micro cable.

- Start up communication software such as "Hyper Terminal" on the PC.
  The communication setups for the communication software should be subject to [4.2.1 Communication protocol].

- Press the ⌾ button on the unit. The measurement data will be transferred to the PC.

4.3   Basic Specifications

CODE No.	Metric	518-230	518-232	518-234	518-236
	Inch/Metric	518-231	518-233	518-235	518-237
Model	Metric	QMH-350A	QMH-600A	QMH-350B	QMH-600B
	Inch/Metric	QMH-14"A	QMH-24"A	QMH-14"B	QMH-24"B
Measuring range (Stroke)		0-465mm (350mm/14")	0-715mm (600mm/24")	0-465mm (350mm/14")	0-715mm (600mm/24")
Resolution	Metric	0.001mm/0.005mm			
	Inch/Metric	0.001mm/0.005mm /.00005"/.0001"/.0002"			
Accuracy (20°C)	Indication accuracy[1]	±(2.4+2.1L/600) µm			
	Repeatability[1]	2σ≤1.8µm			
Perpendicularity (forward and backward direction)[2] (20°C)		7µm	12µm	7µm	12µm
Guiding method		Rolling bearing			
Driving method		Manual (handle drive)			
Detection method		Electromagnetic induction absolute encoder			
Measuring force		1.5±0.5N			
Data output		Digimatic output / USB			
Air float		N/A		Available (only for the purpose of moving the unit)	
Power supply		AA alkaline batteries×4, AC Adapter (optional accessory), Nickel hydride batteries×4 are supported			
Battery life[3]		Approx. 300 hours (continuous use) LED: Other than always-on		Approx. 300 hours (continuous use) LED: Other than always-on	
		Approx. 100 hours (continuous use) LED: Always-on		Approx. 3.3 days (normal use) In the case that the unit is used in 240 days/year, 5 hours/day, while the air float function is used 0.5 hours/day.	
Dimension		350mm/14": 280(W)x273(D)x784(H) 600mm/24": 280(W)x273(D)x1016(H)			
Mass		25kg	29kg	25kg	29kg
Use temperature range (recommended)		0 to 40°C (10 to 30°C)			
Operating humidity range		20 to 80%RH (with no condensation)			
Storage temperature range		-10°C to 50°C			
Storage humidity range		5 to 90%RH (with no condensation)			

CONFORMANCE TO EC DIRECTIVES
This system conforms to the following
EC Directives:2004/108/EC
Standard: EN61326-1:2006
Immunity test requirement: Clause 6.2 Table 2
Emission limit: Class B

NOTE *1: The indication accuracy and repeatability indicate the values that are obtained from height measurement of a flat surface using the standard ø5 stepped probe. In the case of diameter, minimum (maximum) value, or displacement measurement, measuring errors may be larger than the accuracy ratings listed in the table due to variation in measuring force at scanning measurement, different from height measurement.

*2: This perpendicularity indicates the value that is obtained from measurement of a flat surface placed parallel with the base reference surface using the Lever Head (MLH-321) and Mu-checker (M-411).

*3: Battery life depends on its capacity or condition of use. Recommended nickel hydride batteries: Capacity of 1,900 mAh or more

4.4   Standard Accessories

Order No.	Item name	Quantity
05HZA148	ø5 stepped probe	1
12AAA715	Block for calibrating probe diameter	1
06AEW407	Rubber cap (A)	2
06AEW408	Rubber cap (B)	1
－	LR6 (battery)	4
99MAF029B	User's Manual	1
99MAF032M	Unpacking instructions sheet	1
99MAF030M	Setup Procedure Sheet	1
99MAF031M	Quick Reference Manual	1
－	Inspection report	1

4.5   Optional Accessories

Order No.	Item name
Depth measurement	
12AAC072	Depth probe
Interchangeable contact point for ø5 stepped probe	
957261	ø2 ball contact point (coaxial type)
957262	ø3 ball contact point (coaxial type)
957263	ø4 ball contact point (coaxial type)
957264	ø14 disk contact point
957265	ø20 disk contact point
12AAA788	ø4 ball contact point (eccentric type)
12AAA789	ø6 ball contact point (eccentric type)
226116	ø6 collar (used to mount a contact point with ø6 shank)
Special holder, special probe	
12AAA792	Holder for Dial Gage
12AAA793	Long holder
AC Adapter	
06AEG180JA	AD620JA (for Japan)
06AEG180D	AD620D (for EU)
06AEG180E	AD620E (for England)
06AEG180K	AD620K (for Korea)
06AEG180DC	AD620DC (for China)
Connecting cable	
936937	Digimatic cable (1m)
965014	Digimatic cable (2m)
Other	
05HZA143	9×9 adapter (the clamp below is indispensable)
05GZA033	Clamp (for 9×9 adapter)
05HZA144	6.35×12.7 adapter (the clamp assy below is indispensable)
901385	Clamp assy (for 6.35×12.7adapter)
02AZE990	U-WAVE mounting plate

NOTE • The gauge blocks may be required for zero-setting depending on the probes and contact points to be used.

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